

A35976 - 066340.0176

PATENT

REMARKS

Summary of Office Action

Claims 1-10 are pending.

Claims 1-10 have been rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

Claims 1-10 also have been rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent No. 6,101,479 to Koemtzopoulos et al. (hereinafter "Koemtzopoulos").

Applicants' Reply

Applicants have amended the claims for clarity. Applicants respectfully traverse the § 112 and the prior art rejections.

§ 112 rejection

The Examiner finds that the phrase: "a clear signature of an end point," is vague and indefinite. Applicants disagree. However, to expedite prosecution of the application, applicants have now replaced the offending phrase in claim 1 (and claim 4) with the phrase: "the measured voltage profile has a maximum in the voltage profile at the endpoint."

Applicants respectfully submit that amended claims 1-10 now are definite and meet all requirements of § 112.

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Prior Art Rejections.

As noted in the previous Reply (which is incorporated by reference herein), applicants' invention relates to a method for reliable determination of "clean," "sharp" or "abrupt" i.e., unambiguous, endpoints during plasma etch cleaning of processing chambers.

Prior art methods do not provide unambiguous determinations of cleaning endpoints at least in part because the prior art methods measure or monitor inappropriate process parameters, i.e. parameters that do not exhibit a clear unambiguous signature of the cleaning endpoints. As noted in the previous Reply, the cited reference — Koemtzopoulos, measures process voltages at an external tap. Koemtzopoulos only provides a rounded voltage profile, which must have "stabilized" growth rate or flat rate, and which must be correlated with an additional foreline pressure measurement before concluding that the processing chamber is clean. (See Koemtzopoulos, voltage profiles FIGS. 2 and 3, col. 6, lines 11 - 21, col. 6, lines 26 - 31).

In applicants' invention, a DC bias voltage is measured between "ground and a decoupling electrode of the plasma generator disposed within the processing chamber." Applicants submit that the name "decoupling" electrode is a term of art which refers to a "measurement" electrode (e.g., other than the pair of electrodes between which the plasma is generated) to isolate detection currents/voltages from the applied plasma process currents/voltages.

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In any case, applicants' voltage measurement points, according to claims 1 and 4, are such that "the measured voltage profile has a maximum in the voltage profile at the endpoint of the cleaning etching process indicating that the processing chamber is clean". (See e.g., applicants' FIG. 2). Koemtzopoulos does not show teach or suggest such a unambiguous correspondence between the maximum of the voltage profile and the endpoint indicating that the processing chamber is clean (See e.g., Koemtzopoulos Reactor E.P. region above time 106 secs in FIG. 3).

Further, Applicants' invention utilizes data from prior processing runs as the predetermined [or stored] value for comparison with measurements of a current cleaning process run to determine the current endpoint. Careful reading of Koemtzopoulos (in particular, col. 3, lines 8-14, 50-57, col. 6 lines 11-33, col. 7 lines 4-19, and col. 8, lines 29-47 which are cited in the Office Action at ¶ 3) confirms that Koemtzopoulos merely measures or investigates data for a current run to estimate its cleaning endpoint. Applicants note that Koemtzopoulos may store or archive data for purposes other than determining the endpoints of cleaning runs. For example, col. 8 lines 46-53 states "[stored] data in RAM 56 . . . can be used as a diagnostic tool for the cleaning performance of gas from source 24 and the operating condition of the processor including chamber 10," which are purposes other than determining the cleaning end point of a current run. In particular, Koemtzopoulos does not disclose or suggest comparing the measured DC bias voltage in a current cleaning run to a predetermined [or stored] value representing a clean processing chamber, as required by claims 1 and 4.

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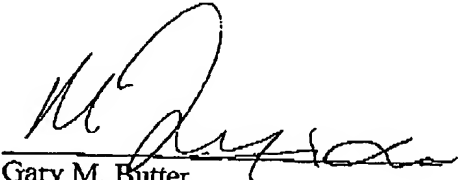
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For at least the foregoing reasons, claims 1 and 4 are patentable over Koemtzopoulos. Further, dependent claims 2, 3 and 5-10, are patentable for over Koemtzopoulos for at least the same reasons discussed above in the context of their parent claims 1 and 4, respectively.

Conclusion

In view of the foregoing remarks, favorable reconsideration and allowance of the pending claims are respectfully solicited. In the event that the application is not deemed in condition for allowance, the examiner is invited to contact the undersigned in an effort to advance the prosecution of this application.

Respectfully submitted,


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